

## Landsat Science: 40 Years of Innovation and Opportunity

Bruce D. Cook, James R. Irons, Jeffrey G. Masek, and Thomas R. Loveland

Landsat satellites have provided unparalleled Earth-observing data for nearly 40 years, allowing scientists to describe, monitor and model the global environment during a period of time that has seen dramatic changes in population growth, land use, and climate. The success of the Landsat program can be attributed to well-designed instrument specifications, astute engineering, comprehensive global acquisition and calibration strategies, and innovative scientists who have developed analytical techniques and applications to address a wide range of needs at local to global scales (e.g., crop production, water resource management, human health and environmental quality, urbanization, deforestation and biodiversity). Early Landsat contributions included inventories of natural resources and land cover classification maps, which were initially prepared by a visual interpretation of Landsat imagery. Over time, advances in computer technology facilitated the development of sophisticated image processing algorithms and complex ecosystem modeling, enabling scientists to create accurate, reproducible, and more realistic simulations of biogeochemical processes (e.g., plant production and ecosystem dynamics). Today, the Landsat data archive is freely available for download through the USGS, creating new opportunities for scientists to generate global image datasets, develop new change detection algorithms, and provide products in support of operational programs such as Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD). In particular, the use of dense (~annual) time series to characterize both rapid and progressive landscape change has yielded new insights into how the land environment is responding to anthropogenic and natural pressures. The launch of the Landsat Data Continuity Mission (LDCM) satellite in 2012 will continue to propel innovative Landsat science.